

Current Research Activities

Monitoring & Detection

Improved microscopy techniques for mussel detection and quantification – Reclamation researchers are working to improve methods for detecting zebra and quagga mussels in water samples. The primary advantage of microscopy is in the ability to visually detect via top level screening to ascertain the presence of larval (veliger) mussels in potentially infested water bodies. Cross-polarized light filters are used to help identify the target organisms. Researchers are also exploring scanning electron microscopy (SEM) to document findings from cross polarization microscopy. This is expected to assist with the identification of suspect organisms and improve confidence for early detection. *Reclamation contact: Denise Hosler (dhosler@do.usbr.gov)*

Improvement of the polymerase chain reaction (PCR) method for quagga mussel detection – Through research funded by Reclamations S&T Program, PCR is being applied for confirmation of the presence of zebra and quagga mussels in water samples. The advantage of PCR is that it potentially represents a highly sensitive method for confirming the presence of mussel DNA in samples observed, through microscopy, to contain veligers. *Reclamation contact: Dr. Kevin Kelly (kkelly@do.usbr.gov)*

Application of advanced “real-time” imaging technologies for detection, identification, and quantification of veliger mussels – New technology has become available to screen water samples and optically detect the presence of veligers. Reclamation’s ZQMRP is exploring and will continue to explore promising methods for continuously monitoring water supplies for the presence of mussels and/or improving methods for analyzing water samples to improve accuracy for early detection. *Reclamation contact: Denise Hosler (dhosler@do.usbr.gov)*

Application of quantitative imaging (optical and acoustic) for monitoring settlement on hydraulic structures – Much of Reclamation’s infrastructure is inaccessible for manual inspection. In cases where manual inspection is possible, time consuming and costly procedures are needed to take equipment off-line for inspection. In other cases, costly underwater inspection using divers is required, but diving is generally limited to depths less than 100 feet. This component of Reclamation’s ZQMRP is geared toward deploying available optical and acoustic imaging technology to effectively inspect inaccessible underwater structures. In partnership with Reclamation’s Lower Colorado Region - Davis Dam, the program will be funding demonstrations to identify promising technologies and develop, as needed, image analysis methods for inspection and monitoring of mussel fouling. *Reclamation contacts: Pete Shaffner (pshaffner@do.usbr.gov) & Tracy Vermeyen (tvermeyen@do.usbr.gov)*

Identification of best monitoring practices – Based on experience gained in the last several years related to monitoring in the western United States, Reclamation researchers are compiling a guidance document that identifies best monitoring practices. The scope will include monitoring for early detection, monitoring to inform maintenance scheduling and/or prevent outages, and monitoring to track population dynamics. *Reclamation contact: Dr. Chris Holdren (choldren@do.usbr.gov)*

Control

Controlling Zebra and Quagga Mussels with *Pseudomonas fluorescens* – In partnership with Reclamation's LC Region - Davis Dam, New York State Museum (NYSM), and Marrone Organics, Inc. (MOI), Reclamation's ZQMRP is working toward field demonstration of effectiveness of *P. fluorescens* in controlling both adult and veliger zebra and quagga mussels. These demonstrations are expected to highlight the efficacy of this treatment approach in both cleaning and maintaining pipelines and structures with significant quagga mussel fouling. *Reclamation contacts: Fred Nibling (fnibling@do.usbr.gov) & Dr. Kevin Kelly (kkelly@do.usbr.gov)*

Evaluation of coatings to minimize settlement of adult mussels and/or improve cleaning - Through efforts funded by Reclamation's S&T Program, a wide variety of coatings are being evaluated in partnership with Reclamation's LC Region – Parker Dam. While this study is expected to expand in scope and continue for several years, our current understanding regarding the effectiveness (or lack thereof) of different coatings in the context of mussel fouling is already improving. *Reclamation contact: Dr. Allen Skaja (askaja@do.usbr.gov)*

Identification of potential anti-fouling materials of construction – Recognizing the likelihood that coatings will not solve every problem related to maintaining Reclamation infrastructure, the ZQMRP is exploring alternative materials of construction that can be used to retrofit existing structures. One particular example involves positive barrier fish screens. While certain anti-fouling materials do exist, it is not yet entirely clear what are the most effective from the standpoint of the wide range of potential applications. Reclamation researchers are working to identify alternative materials for the various applications of interest. The most promising of which will be field evaluated in the coming year. *Reclamation contacts: Dr. Allen Skaja (askaja@do.usbr.gov) & Aaron Muehlberg (amuehlberg@do.usbr.gov)*

Evaluation of filters & UV light treatment to minimize facilities impacts – In partnership with Reclamation's LC region – Hoover Dam, Reclamation researchers will be evaluating ultraviolet (UV) treatment as a means for controlling mussel settlement in drinking water supply lines and power plant cooling water systems. The primary advantage of this treatment method is that it would eliminate the need for discharge permitting and it represents an environmentally safe alternative to conventional oxidants. An added advantage of UV is the known effective treatment for other waterborne organisms in drinking water systems. If demonstrated effective for control of mussels, UV treatment is expected to have broad application across Reclamation and throughout the western United States. *Reclamation contacts: Fred Nibling (fnibling@do.usbr.gov) & Leonard Willett (lwillett@lc.usbr.gov)*

Evaluation of spray systems for pipe and trashrack cleaning – In conjunction with the *Pseudomonas fluorescens* testing to be conducted at Davis Dam, Reclamation's ZQMRP is assisting with modifications to the domestic water supply intakes. In addition to providing a test facility for various treatment options, the proposed retrofits are expected to allow for demonstration of conventional spray cleaning methods for pipelines. The advantage of this approach is that the plant will have an alternate means for long term maintenance at regular intervals should other treatment options prove ineffective. As part of this effort, Reclamation will also be testing various underwater cleaning systems for trashracks (mechanical and jetting type systems). *Reclamation contacts: Dr. Allen Skaja (askaja@do.usbr.gov)*

Evaluation of plasma shock cleaning methods for hydraulic structures – Reclamation's ZQMRP is exploring other cleaning technologies in addition to the conventional methods describe above. In particular, underwater plasma shock cleaning appears promising. Although we are in the early stages of exploration, we hope to enable opportunities for field demonstrations in the coming year.

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Evaluation of filtration systems for excluding zebra and quagga mussels from power plant cooling water systems – Although filtration obviously has limited application due to the relatively low capacity, there are many situations in which filtration is promising. Reclamation researchers in partnership with Reclamation's LC Region – Parker Dam will be evaluating a 50 and 100 micron self cleaning filtration system developed for ballast water applications. The purpose of the evaluation is to demonstrate the practicality and effectiveness of filtration in preventing settlement in the domestic water supply system. The added advantage of filtration is that it eliminates the need for conventional oxidants.

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Environmental Impacts

Long-term ecological impacts within and downstream of infested reservoirs – Recent infestations in the western United States are expected to have significant environmental impacts similar to those currently being experienced in the Great Lakes. However, it is also recognized that the western United States ecosystems exhibit different environmental conditions. As such, an improved understanding of the ecological impacts associated with zebra and quagga mussel infestations in the West is needed. The findings are expected to highlight issues and assist in future prioritization of actions for mitigating zebra and quagga mussel impacts on natural resources. *Reclamation contacts: Dr. Chris Holdren*

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